

WHAT IS CLAIMED IS:

1. A method for determining lattice points to be referenced to prepare correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, said method comprising:

referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space;

prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space;

optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied; and

referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in

the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data.

2. The method for determining lattice points to be referenced to prepare the correspondence defining data as defined in Claim 1, wherein the step of acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space by referencing the original correspondence defining data is accomplished by performing colorimetry on patches printed with each ink in single color and calculating by approximate calculation the color component value in the device-independent color space, by referencing the resulting colorimetric values, thereby acquiring correspondence between the combination of ink amounts prescribed in the original correspondence defining data and the color component value in the device-independent color space.

3. The method for determining lattice points to be referenced to prepare the correspondence defining data as defined in Claim 1, wherein the smoothness evaluation function assumes a function form which varies for each region in the color gamut to which the lattice point to be optimized belongs.

4. The method for determining lattice points to be referenced to prepare the correspondence defining data as defined in Claim 1, wherein the smoothness evaluation func-

tion is a function which contains the absolute value of the sum of the vectors which are oriented toward the adjacent lattice points adjacent to the lattice point to be optimized and which are also oriented in the mutually opposite directions.

5. The method for determining lattice points to be referenced to prepare the correspondence defining data as defined in Claim 4, wherein, if the lattice point to be optimized belongs to the edge line on the boundary of the color gamut, the adjacent lattice points are those which exist on the edge line and also exist at mutually opposite sides with respect to the lattice point to be optimized.

6. The method for determining lattice points to be referenced to prepare the correspondence defining data as defined in Claim 4, wherein, if the lattice point to be optimized belongs to the outer plane on the boundary of the color gamut, the adjacent lattice points are those which exist on the outer plane and also exist at mutually opposite sides with respect to the lattice point to be optimized.

7. The method for determining lattice points to be referenced to prepare the correspondence defining data as defined in Claim 4, wherein, if the lattice point to be optimized belongs to the inside of the boundary of the color gamut, the adjacent lattice points are those which belong to the color gamut and also exist at mutually opposite sides with respect to the lattice point to be opti-

mized.

8. An apparatus for determining lattice points to be referenced to prepare correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, said apparatus comprising:

a unit to record the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space;

a unit to acquire correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space by referencing the original correspondence defining data;

a unit to calculate a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space;

a unit to optimize the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied; and

a unit to reference the original correspondence defining

data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data.

9. A program product which enables the computer to realize the capability of determining lattice points to be referenced to prepare correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, said program product comprising:

- a feature to record in a prescribed recording medium the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space and to acquire correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space by referencing the original correspondence defining data;
- a feature to calculate a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space;
- a feature to optimize the arrangement of lattice points in

the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied; and

a feature to reference the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data.

10. A print controlling apparatus for generating the printing data which permit printing by referencing correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system and converting the color component value in the color system into the amount of ink, which is characterized in that:

the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smooth-

ness of arrangement of lattice points in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.

11. A print controlling method for generating the printing data which permit printing by referencing correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system and converting the color component value in the color system into the amount of ink, which is characterized in that:

the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry



for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.

12. A print controlling program product which enables the computer to realize the capability of generating the printing data which permit printing by referencing correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system and converting the color component value in the color system into the amount of ink, which is characterized in that:  
the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the

lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component value in the color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.

13. A color converting apparatus which references correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, thereby converting the color component value in the color system into the amount of ink, which is characterized in that: the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice

points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.

14. A color converting method which references correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, thereby con-

verting the color component value in the color system into the amount of ink, which is characterized in that: the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component

value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.

15. A color converting program product which references correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, thereby converting the color component value in the color system into the amount of ink, which is characterized in that:

the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the

rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.